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Title of the Invention:

CONDUCTIVE RESIN COMPOSITION

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(72) Inventor: H. Iwase
Toshiba Chemical Corporation
14-25 Ryoke 5-chome, Kawaguchi City

(71) Applicant: Toshiba Chemical Corporation
3-9, Shinbashi 3-chome, Minato-ku, Tokyo

(74) Authorized Agent: E. Morota, Patent Attorney

SPECIFICATION

1. Title of the Invention:

CONDUCTIVE RESIN COMPOSITION

2. Scope of the Patent Claim(s):

1. A conductive resin composition characterized in that 1–10 weight% of

SUS304 stainless steel fiber is incorporated as a conductive filler in a synthetic resin.

2. The conductive resin composition of Claim 1, wherein the SUS304 stainless steel fiber has a composition consisting of up to 0.08% carbon, up to 1.00% silicon, up to 2.00% manganese, up to 0.045% phosphorus, up to 0.030% sulfur, 8.00–10.50% nickel, 18.00–20.00% chromium, with the remainder consisting of iron.

3. Detailed Description of the Invention

Technical Field of the Invention

The present invention pertains to conductive resin compositions with excellent conductivity containing SUS304 stainless steel fiber.

Technical Background of the Invention and Attendant Problems

In the past, one or more of carbon powder, carbon fiber, metal powder, and metal fiber have been used to provide conductivity, when a conductive resin was to be obtained by adding and mix-kneading a conductive filler in a synthetic resin. However, carbon powder and carbon fiber are not good enough to yield a high conductivity of 10^{-1} Ω-cm or less in terms of volume resistivity, and the mix-kneading of a metal powder had the drawback that high conductivity could not be provided unless 60 weight% or more, based on the weight of the resin, of the metal power was incorporated. Furthermore, when the metal fiber is copper or brass fiber with thick filament diameters, 30 weight% or more of the fiber must be added, which presents a problem in that the specific gravity is increased. Moreover, if SUS316 stainless steel fiber with thin filament diameters is incorporated, the viscosity of the resin increases, or the fiber gets severed by the mechanical kneading process during the production stage of a resin composition and predetermined

conductivity cannot be provided, thus there has been problem in that 15 weight% or more of the fiber has to be incorporated.

Object of the Invention

The present invention was developed to solve the problems of the above-mentioned conventional techniques; thus, the object of the present invention is to provide a conductive resin composition with a lower filler content, excellent conductivity, lower specific gravity, and low cost.

Abstract of the Invention

The present inventor carried out extensive studies to achieve the above-mentioned objectives, and found that a resin composition with excellent conductivity, low specific gravity, and low cost can be obtained if a predetermined amount of SUS304 stainless steel fiber is used as the filler. It was this finding that led to the development of the present invention.

Specifically, the present invention comprises a conductive resin composition characterized in that 1–10 weight% of SUS304 stainless steel fiber is incorporated as a conductive filler in a synthetic resin. And the SUS304 stainless steel fiber itself has a composition consisting of up to 0.08% carbon, up to 1.00% silicon, up to 2.00% manganese, up to 0.045% phosphorus, up to 0.030% sulfur, 8.00–10.50% nickel, 18.00–20.00% chromium, with the remainder consisting of iron.

The synthetic resin to be used in the present invention can be selected from among polystyrene resins, ABS resins, polycarbonate resins, polybutadiene resins, modified PPO

resins, polybutylene terephthalate resins, unsaturated polyester resins, phenolic resins, and epoxy resins, and these are used singly or in combinations of two or more.

The stainless steel fiber to be used as a conductive filler in the present invention is made of a material called SUS304, and consists of a bundle of 1,000–15,000 filaments 6–15 μm in diameter. If the filament diameter is less than 6 μm, the viscosity of the resin rises, and when it is greater than 15 μm the cost increases, which is undesirable. The SUS304 stainless steel fiber has a composition consisting of up to 0.08% carbon, up to 1.00% silicon, up to 2.00% manganese, up to 0.045% phosphorus, up to 0.030% sulfur, 8.00–10.50% nickel, 18.00–20.00% chromium, with the remainder consisting of iron, and contains more chromium and less nickel than ordinary SUS316 stainless steel, and contains no molybdenum at all. Therefore, this fiber is a little harder than fiber of SUS316, and has the property of very little bending and breakage of the fiber. Furthermore, this fiber is weakly magnetic, whereas SUS316 is nonmagnetic. It is desirable for the incorporated amount of SUS304 stainless steel fiber to be 1–10 weight% based on the weight of the resin composition. When the amount incorporated is less than 1 weight%, the fiber is not effective in imparting conductivity, and with more than 10 weight%, the specific gravity increases and so does the cost, which is undesirable. Accordingly, the content should be limited within said range.

For producing a conductive resin composition with the use of a synthetic resin and SUS304 stainless steal fiber, the synthetic resin and stainless steel fiber are heated and mix-kneaded, as is usually done. The conductive resin composition of the present invention can be combined with other additives -- if needed -- without thereby impairing the effect of the present invention. The conductive resin composition thus obtained can

be used for electromagnetic wave shielding molded articles for electronic instruments, etc.

ACTUAL EXAMPLES OF THE INVENTION

The present invention will now be illustrated by actual examples, however, it should be understood that the present invention is not limited by these actual examples in any way.

Actual Examples 1–2

Conductive resin compositions were produced by using compositions as shown in Table 1, binding a bundle of 6,000 SUS304 stainless steel filament fibers 8 μm in diameter with polyethylene terephthalate, cutting the bundle into 5-mm long strands, and heating and mix-kneading the chopped strands with a polystyrene resin. These compositions were injection molded to obtain molded articles, and their volume resistivity and specific gravity were tested; the results are shown in Table 1. The conductive resin compositions of the present invention had small volume resistivities and small specific gravities; thus, the effect of the present invention was achieved.

Comparison Example

A conductive resin composition was produced in a manner similar to that of Actual Examples 1–2 by using a composition as shown in Table 1, binding a bundle of 6,000 SUS316 stainless steel filament fibers 8 μm in diameter with polyethylene

terephthalate, and cutting the bundle into 5-mm long strands. This conductive resin composition was then injection molded in a manner similar to that of Actual Examples 1–2 to obtain a molded article, which was tested in a manner similar to that of said Actual Examples. The results are shown in Table 1.

(b) 項目	(d) 実施例 1	(d) 実施例 2	比較例 (e)
(f) 組成 (重量部)			
(g) ポリスチレン樹脂	90	97	85
(h) 導電性充填材 *1			
(i) SUS304ステンレス繊維	10	3	–
(j) SUS316ステンレス繊維	–	–	15
(k) 特性			
(l) 体積抵抗率 (Ω・cm)	7.8×10^{0}	9.1×10^{2}	9.0×10^{2}
(m) 比重	1.15	1.09	1.21

(a) (単位)

(n) *1 : 繊維径 8μm、繊維長 5mm の繊維

Table 1. KEY: (a) (unit); (b) item; (c) example; (d) Actual Example; (e) Comparison Example; (f) composition (parts by weight); (g) polystyrene resin; (h) conductive filler *1; (i) SUS304 stainless steel fiber; (j) SUS316 stainless steel fiber; (k) characteristics; (l) volume resistivity (Ω-cm); (m) specific gravity; and (n) *1: fiber with a filament diameter of 8 μm and a length of 5 mm.

Effect of the Invention

The conductive resin compositions of the present invention can yield molded articles with excellent conductivity in spite of low filler contents, and with low specific gravities, and low cost, by incorporating predetermined amounts of SUS304 stainless steel fiber. The viscosity of the resin did not rise and the specific gravity did not increase, because the amount of stainless steel incorporated was small; in addition, the fiber did not break by mechanical mix-kneading, and excellent conductivity was exhibited.